



Office of Intellectual Property Counsel
 3M Innovative Properties Company
 PO Box 33427
 St. Paul, Minnesota 55133-3427
 651/733 1500

PATENT

Docket No.

55420USA9A.002

JC490 U.S. PTO

09/566119

**Transmittal of Patent Application - Rule 1.53(b)**

Box: Patent Application
 Assistant Commissioner for Patents
 Washington, D.C. 20231

Inventor(s): Michael D. Hamerski
 Title: ADHESIVE ARTICLE WITH PROGRESSIVE ADHESIVE PROPERTIES
 AND METHOD OF USING SAME

1. ☒ Enclosed is the above-mentioned new patent application. It includes 3 sheet(s) of drawings.
2. ☒ Enclosed is an executed declaration.
3. ☒ Enclosed are an application assignment to 3M Innovative Properties Company and a completed Assignment Recordation Cover Sheet.
4. ☐ Enclosed is a Certified Copy of Priority Document(s) _____ (if foreign priority is claimed).
5. ☐ Enclosed is _____.
6. ☒ The fee for filing the application is computed as follows:

Claims As Filed				
(1) For	(2) Number Filed	(3) Number Extra	(4) Rate	(5) Basic Fee \$690.00
Total Claims	34 -20 =	14	x \$18.	\$ 252.00
Independent Claims	4 -3 =	1	x \$78.	\$ 78.00
Additional fee for filing one or more multiple dependent claims			\$260.	\$ - 0 -
Total amount due →				\$1,020.00

7. ☒ Please charge to Deposit Account 13-3723 any fees under 37 CFR 1.16 and 1.17 which may be required to file and during the entire pendency of this application. This authorization includes the fee for any extension of time under 37 CFR 1.136(a) that may be necessary. To the extent any such extension should become necessary it is hereby requested. A copy of this transmittal letter for fee processing is enclosed.
8. ☒ Enclosed is a return receipt postcard

Respectfully submitted

Registration Number	Telephone Number
39,326	(651) 736-4713
Date	
June 2, 2000	

Signature
<i>David B. Patchett</i>
Print Name
David B. Patchett

Certificate of Express Mailing	
Pursuant to 37 CFR 1.10 I certify that this application is being deposited on the date indicated below with the United States Postal Service "Express Mail Post Office to Addressee" service addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.	
Express Mail Mailing Label No.	Signature of Person Mailing Application
EL421369052US	<i>Susan M. Hendrickson</i>
Date of Deposit	Printed Name of Person Mailing Application
June 2, 2000	Susan M. Hendrickson

**ADHESIVE ARTICLE WITH PROGRESSIVE ADHESIVE PROPERTIES
AND METHOD OF USING SAME**

Field of the Invention

The present invention relates to an adhesive article with a failure mode that minimizes damage to the substrate surface and a method of using the same. The present invention also relates to an adhesive article that can be removed in a reverse peel mode without damaging the substrate.

Background of the Invention

Adhesives provide a convenient and low cost way of mounting various structures, such as picture hangers or utility hooks, to walls and other substrates. The nature of adhesives is such that there is often a possibility of damage to the substrate (wall) when a substantial load is applied to the structure. If the load that is applied to the structure exceeds the weight rating of the structure, or adhesion to the substrate is weak, there is a high probability that a peel mode failure will occur. During a peel mode failure, there is a likelihood of wall damage, typically at the bottom of the structure.

While not being bound by theory, it appears that Figures 1-3 illustrate the failure mode, as best understood, of conventional adhesives used to attach articles to walls. As illustrated in Figure 1, hook 20 is attached to substrate 22 by an adhesive layer 24. Load 26 creates a tensile load that produces a peel force 28 near the top of the hook 20 and a compressive load 30 near the bottom of the hook 20. That is, the load 26 creates peel or cleavage de-bonding at the top of the hook 20. As illustrated in Figure 2, peel force 28 causes the hook 20 to separate slowly from the substrate 22 near the top of the hook 20. As the hook 20 separates from the substrate 22, a pivot point is created generally in the region 32 near the bottom of the hook 20, increasing the compressive

load 30 and the adhesion in the region 32. At some point during the delamination process, the hook 20 makes a transition from compression to peel/cleavage in the region 32. Since the surface area of the interface between the adhesive layer 24 and the substrate surface 34 in the region 32 is relatively small, there is a high probability of failure at the surface 34.

As a result of the increased adhesion in the region 32, damage 36 can be caused to the substrate surface 34, as illustrated in Figure 3. Portion 38 of the substrate surface 34 typically remains bonded to the adhesive layer 24. Where the substrate surface 34 is paint, wallpaper, wallboard, or a variety of other interior surfaces, the cost of repairing the damaged area can be considerable. In some situations, even a small amount of damage may require the entire wall or room to be repainted.

It is therefore desirable to provide an adhesive article with a failure mode that minimizes damage to the substrate surface. It is also desirable to provide an adhesive article that can be removed from the substrate in reverse peel mode without damaging the substrate.

Brief Summary of the Invention

The present invention relates to an adhesive article adapted to attach structures to substrates and a method of using the same. The present invention also relates to a mounting system for a substrate using the present adhesive article.

The present adhesive article permits the use of a high-strength adhesive to attach structures to substrates, with a failure mode that minimizes damage to the substrate surface. The present adhesive article can either be peel removable or stretch releasing. In some embodiments, the peel removable nature of the adhesive article flows from reduced adhesive properties arranged in the desired direction of peel. In these embodiments, the properties that provide the peel removable nature of the adhesive article also minimize the damage to the substrate surface.

In one embodiment, the adhesive article comprises an adhesive layer having a first adhesive region and a second adhesive region. The first adhesive region

is adapted to attach a top portion of the structure to the substrate. The second adhesive region is adapted to attach a bottom portion of the structure to the substrate. The second adhesive region comprises reduced adhesive properties.

5 In one embodiment, the adhesive article comprises a stretch releasing adhesive tape. The stretch releasing adhesive tape includes a pull-tab adjacent to the second adhesive region.

10 In another embodiment, the adhesive layer comprises a plurality of adhesive regions with progressively reduced adhesive properties. In another embodiment, a single adhesive region comprises progressively reduced adhesive properties, such as by changing the surface area of the adhesive regions.

15 In one embodiment, the second adhesive region comprises a surface area greater than or equal to about 22% of a surface area of the adhesive layer. In another embodiment, the second adhesive region comprises a surface area more than about 22% of a surface area of the adhesive layer. The second adhesive region can be selected from the group consisting of release liner material, repositionable pressure sensitive adhesive, polymeric film, paper, scrims, nonwoven fabrics, powder, ink, and low adhesion backsize material.

20 The present invention is also directed to a mounting system for a substrate. The structure may be a variety of articles, such as hooks, picture mounting tabs and the like.

25 The present invention is also directed to a method of attaching a structure to a substrate. An adhesive article is prepared comprising an adhesive layer having a first adhesive region and a second adhesive region. The second adhesive region comprises reduced adhesive properties. The adhesive article is attached to the structure so that the first adhesive region extends distally from a top portion of the structure and the second adhesive region extends distally from a bottom portion of the structure. The first and second adhesive regions are attached with the substrate.

In one embodiment, the adhesive layer comprises a plurality of adhesive regions with progressively reduced adhesive properties. The structure can be removed

from the substrate by delaminating the adhesive article in the direction from the adhesive region with the lowest adhesive properties toward the adhesive region with the greatest adhesive properties. In another embodiment, the adhesive layer is a stretch releasing adhesive article with a pull tab adjacent to the second adhesive region.

5

Brief Description of the Several Views of the Drawing

The present invention will be further described with reference to the accompanying drawings, in which:

10 Figure 1 is a side view of a prior art adhesive layer used to mount a hook structure to a substrate.

Figure 2 is a side view of the hook structure of Figure 1 delaminating from the substrate.

Figure 3 is a side view of damage caused to the substrate upon removal of the hook structure of Figure 2.

15 Figure 4A is a side view of a structure attached to a substrate using an adhesive article in accordance with the principles of the present invention.

Figure 4B is a side view of the adhesive article of Figure 4A delaminating from the substrate in accordance with the principles of the present invention.

20 Figure 4C is a side view of the adhesive article of Figure 4A delaminated from the substrate in accordance with the principles of the present invention.

Figure 5 is a side view of a structure attached to a substrate using an alternate adhesive article in accordance with the principles of the present invention.

25 Figure 6 is a side view of a structure attached to a substrate using another alternate adhesive article in accordance with the principles of the present invention.

Figure 7 is a side view of a structure of Figure 6 being removed from the substrate in accordance with the principles of the present invention.

Figure 8 is a front view of an adhesive article with a progressively reduced adhesive properties in accordance with the principles of the present invention.

Detailed Description of the Invention

Figure 4A is a side sectional view of a structure 50 mounted to a substrate 52 using an adhesive article 54 in accordance with the principles of the present invention. Although the structure 50 illustrated in Figure 4A is a hook, any of a variety of structures can be attached to the substrate 52 using an adhesive article in accordance with the principles of the present invention. Adhesive article 54 has a first adhesive layer 56 engaged with substrate surface 58. The first adhesive layer 56 of the adhesive article 54 includes a first adhesive region 64 near the upper portion of the structure 50 and a second adhesive region 66 near the bottom portion of the structure 50. The second adhesive region 66 has reduced adhesive properties. As used herein, "reduced adhesive properties" refers to a region with non-adhesive properties or adhesive properties less than the adhesive properties of the first adhesive region. As such, the concept of reduced adhesive properties is a comparison of the relative adhesive properties of the first and second adhesive regions. Various methods of achieving the reduced adhesive properties are discussed below.

Second surface 60 of adhesive article 54 engages with rear surface 62 of the structure 50. The second surface 60 is typically an adhesive bonded to the rear surface 62 of the structure 50. In some embodiments, the adhesive article 54 may be a two-sided adhesive tape with a backing layer (see e.g., Figure 5). The backing layer can be paper, a polymeric foam, a polymeric film, a scrim, a nonwoven, or a variety of other materials. The choice of polymeric foam or polymeric film depends on the specific application for the adhesive article 54. Polymeric foams can be chosen to optimize conformability and resiliency properties which are helpful when the adhesive article 54 is to be adhered to surfaces having surface irregularities. Such is the case with a typical wall surface. Polymeric films may be used instead to increase load bearing strength and rupture strength of the tape; however, films are more suitable when the application is to adhere two very smooth surfaces together. As an alternative,

solid adhesives can be used instead of the combination of a film or foam with two adhesive layers.

When the structure 50 is subject to tensile load 70, peel force 72 is generated near the top of the structure 50, generally opposite the first adhesive region 64. The first adhesive region 64 counteracts the peel force 72. Simultaneously, a compressive force 74 is generated in region 76 adjacent to the second adhesive region 66. The load 70 also generates a shear force 78. In one embodiment, the second adhesive region 66 is engineered to frictionally engage with the substrate surface 58 to resist shear force 78. For example, the second adhesive region 66 may be a non-adhesive, rubber material that has a high frictional coefficient with respect to the substrate surface 58, but no adhesive properties. A variety of other high friction, non-adhesive materials may be used for the second adhesive region 66, where the selection of the material is determined in part by the nature of the substrate surface 58. In an alternate embodiment, the second adhesive 66 can be formed on both sides of the adhesive article 54 so that the adhesive article 54 is orientation independent. Alternatively, adhesive article 54 in the region 76 can be constructed from a material with reduced adhesive properties (see e.g., Figure 6).

Figures 4B and 4C illustrate the failure mode of the adhesive article 54 of Figure 4A. As the load 70 is increased, the peel force 72 causes the first adhesive region 64 to delaminate from the substrate surface 58. As the structure 50 continues to separate from the substrate 52, it pivots against the substrate surface 58 in the region 76 near the bottom of the structure 50, increasing the compressive load 74. The reduced adhesive properties in the region 76 minimize adhesion, even in the presence of the increased compressive load 74.

At some point during the delamination process, the structure 50 makes a transition from compression to peel/cleavage in the region 76. Since the adhesion at the interface between the adhesive layer 54 and the substrate surface 58 in the region 76 is relatively low, there is a low probability of failure at the substrate surface 58. Figure 4C

illustrates the structure 50 completely delaminated without damaging the substrate surface 58.

The size of the second adhesive region 66 having reduced adhesive properties will vary with the application and the nature of the structure 50. If the first adhesive region 64 is too large, it will extend into the region 76 and may cause the damage to the substrate 22 illustrated in Figure 3. Alternatively, if the second adhesive region 66 is too large, the bond strength between the structure 50 and the substrate 52 may be inadequate for some applications. In the embodiment illustrated in Figure 4A, the second adhesive region 66 has a surface area greater than or equal to about 22% to about 30% of the surface area of the first adhesive layer 56. In another embodiment, the second adhesive region 66 has a surface area of more than 30% of the surface area of the first adhesive layer 56.

The reduced adhesive properties can be achieved through the application of materials, such as films, papers, powders, foams, scrims, nonwoven fabrics, inks, other coatings and treatments, and the like to render the second adhesive region 66 either non-adhesive or low adhesive. Alternatively, a composition of less aggressive adhesion material can be used in the second adhesive region 66. Such low-adhesion material can be applied directly to the adhesive article 54 or may be coated to the surface 56 of the adhesive article 54 in the region 66. Alternatively, the adhesive can be coated as dots where the density of the dots is decreased to generate the reduced adhesive properties. Alternatively, the surface area of the second adhesive region 66 per unit of length can be reduced to produce the reduced adhesive properties (see Figure 8).

Any adhesive composition exhibiting a lower adhesion than the adhesive in the first adhesive region 64 is contemplated, including the other compositions of the adhesive materials listed below. Moreover, adhesive detackification or coating techniques can be utilized. One specific example of a low-tack adhesive deemed suitable for many applications is the adhesive used in making Post-it™ repositionable notes which are commercially available from Minnesota Mining and Manufacturing

Company of Saint Paul, Minn.

Instead of using a less aggressive adhesive composition to define a reduced adhesive portion, the region 66 can be coated with a release material such as a silicone release coating. Alternatively, the reduced adhesive properties may be produced through molding or profiling of a textured area which significantly reduces adhesive contact. Various techniques for changing adhesive properties are disclosed in U.S. Patent No. 6,001,471 (Bries et al.).

Figure 5 is a side view of an alternate adhesive article 90 for attaching structure 50 to substrate 52 in accordance with the principles of the present invention. The adhesive article 90 comprises a backing layer 92 and adhesive layers 94, 96 of the same or different pressure sensitive adhesive compositions on the opposite major surfaces thereof. The backing layer 92 may be a polymeric film or foam layer chosen to optimize conformability and resiliency properties that are helpful when the adhesive article 90 is adhered to a substrate surface 58 with irregularities. Various backing layers 92 are disclosed in U.S. Patent No. 6,001,471 (Bries et al.).

Adhesive layer 96 preferably corresponds with rear surface 62 of the structure 50 to which it is adhered such that tab 98 extends from the structure 50 to facilitate stretch removal of the adhesive article 90. Alternatively, the tab 98 can extend from the top or the sides of the structure 50. Adhesive layer 94 comprises a first adhesive region 100 and a second adhesive region 102 located near the bottom of the structure 50. The second adhesive region 102 comprises reduced adhesive properties located at an interface with the substrate surface 58. The second adhesive region 102 minimizes excessive bonding of the region 76 with the substrate surface 58. The reduced adhesive properties of the second adhesive region 102 provide the adhesive article 90 with a failure mode substantially as illustrated in Figures 4B-4C.

The structure 50 is removed from the substrate 52 by pulling the tab 98 along the direction 104. The release of adhesive layer 94 progresses substantially even with the release of adhesive layer 96 to achieve complete release of the adhesive layer 94 from the substrate surface 58.

liners include kraft papers, polyethylene, polypropylene, polyester or composites of any of these materials which can be coated with release agents such as fluorochemicals or silicone. U.S. Patent No. 4,472,480 describes low surface energy perfluorochemical liners. The preferred liners are papers, polyolefin films, or polyester films coated with
5 silicone release materials. Examples of the silicone coated release papers are Polyslik trade silicone release papers supplied by James River Co., H.P. Smith Division (Bedford Park, IL), and silicone coated papers supplied by DCP-Lohja Inc. (Willowbrook, Illinois).

Figure 6 is a side sectional view of an alternate adhesive article 120 in
10 accordance with the principles of the present invention. Adhesive article 120 has a plurality of adhesive regions 122, 124, 126, 128. Adhesive region 122 has the greatest level of adhesion with the substrate surface 58 of the substrate 52. Each of the adhesive regions 124, 126, 128 have a progressively lower level of adhesion and each comprises reduced adhesive properties with respect to regions of high adhesion. For example,
15 adhesive region 124 has a lower level of adhesion than region 122. Consequently, region 124 comprises reduced adhesive properties relative to region 122. Similarly, adhesive region 126 has a lower level of adhesion than regions 122, 124. Adhesive region 128 has the lowest level of adhesion with the substrate surface 58.

Adhesive region 128 is configured to prevent excessive bonding with the
20 substrate surface 58 caused by compressive force 74 when the load 70 is placed on the structure 50 as discussed above. The failure mode of the adhesive article 120 minimizes damage to the substrate surface 58 as generally illustrated in Figures 4A-4C.

As illustrated in Figure 7, the adhesive article 120 of Figure 6 has the added advantage that the structure 50 can be removed from the substrate surface 58 by
25 delaminating in the direction 130, also referred to as "reverse peel". Reverse peel refers to delaminating a structure in a direction from the region of lowest adhesive properties to the region of highest adhesive properties.

The normal stress applied to the adhesive article 120 when used for vertical mounting is peel force 72 is near the top of the structure 50, generally opposite

the adhesive region 122. The adhesive region 122 counteracts the peel force 72. Simultaneously, a compressive force 74 is generated in adhesive region 128. The adhesive properties of the adhesive region 122 need to be greater than the adhesive properties in the region 128. The adhesive properties in the adhesive region 122 preferably are at a level that will not damage the substrate surface 58 during reverse peel. Although the difference in adhesive properties from the region 122 to the region 128 are illustrated as a series of steps, a gradient or gradual change in adhesive properties is also possible (see Figure 8).

Delaminating in the direction 130 reverses the normal forces so that peel is now applied to the areas of the adhesive article 120 that has the weakest peel strength. The structure 50 can be lifted starting at the bottom and gradually working upward through the various adhesive regions. The adhesive regions 122, 124, 126, 128 progressively delaminate from the surface 58 from the region with the lowest level of adhesion 128 to the region of the highest adhesion 122.

Figure 8 illustrates an alternate adhesive article 140 with a backing layer 142 and an adhesive layer 144. The adhesive layer 144 is separated generally into a first adhesive region 146 and a second adhesive region 148. The second adhesive region 148 has reduced adhesive properties relative to the first adhesive region 146 through the use of a reduced surface area. That is, the surface area of the second adhesive region 148 per unit length "L" is less than the surface area of the first adhesive region 146. The failure mode of the adhesive article 140 minimizes damage to the substrate surface 58 as generally illustrated in Figures 4A-4C.

The shape of the first and second adhesive regions 146, 148 can vary as long as the overall adhesive surface area in the region 148 is less than the adhesive surface area in the region 146. The reduced surface area in the region 148 can be achieved by coating the adhesive layer 144 in a tapered configuration. Alternatively, the adhesive layer 144 can cover the entire surface area of the backing layer 142 and portions 150, 152 can be modified to have non-adhesive or reduced adhesive properties, such as by application of a non-adhesive liner or a variety of other techniques discussed

above. In yet another embodiment, an adhesive article can be cut into non-rectangular shapes so that the reduced surface area in the second adhesive region 148 is achieved with or without the portions 150, 152.

5 In one embodiment, the adhesive article 140 is a conventional adhesive that can be removed from a substrate by reverse peel, starting in the first adhesive region 148 and progressing toward the second adhesive region 146. In another embodiment, the adhesive article 140 is a stretch releasing adhesive that is removed from a substrate using pull tab 154.

10 The patents, patent documents, and patent applications cited herein are incorporated by reference in their entirety as if each were individually incorporated by reference. While several embodiments of the invention have been illustrated and described, it will be recognized that various changes and modifications may be made without deviating from the inventive concept set for the above. Any of the features of the various embodiments disclosed herein can be combined. It will be apparent to those
15 of ordinary skill in the art that various changes and modifications may be made without deviating from the inventive concept set forth above. Thus, the scope of the present invention should not be limited to the structures described in this application, but only by the structures described by the language of the claims and the equivalents of those structures.

20

What is claimed is:

1. An adhesive article adapted to attach structures to a substrate comprising a stretch releasing adhesive article having an adhesive layer with a first adhesive region adapted to attach a top portion of the structure to the substrate and a
5 second adhesive region with reduced adhesive properties adapted to attach a bottom portion of the structure to the substrate, the stretch releasing adhesive article including a pull tab attached to the stretch releasing adhesive article adjacent to the second adhesive region.

10 2. The adhesive article of claim 1 wherein the stretch releasing adhesive tape comprises a multi-layer structure.

3. The adhesive article of claim 1 wherein the stretch releasing adhesive tape comprises a backing layer selected from one of a film, an elastic foam,
15 and an inelastic foam.

4. The adhesive article of claim 1 wherein the stretch releasing adhesive tape comprises one of a pressure sensitive adhesive tape with an elastic structural member, a pressure sensitive adhesive tape with a highly extensible and
20 substantially inelastic structural member, or a solid pressure sensitive adhesive.

5. The adhesive article of claim 1 wherein the adhesive layer comprises more than two adhesive regions.

25 6. The adhesive article of claim 1 wherein the adhesive layer comprises a plurality of adhesive regions with progressively reduced adhesive properties.

7. The adhesive article of claim 1 wherein the adhesive layer comprises progressively reduced adhesive properties.

5 8. The adhesive article of claim 1 wherein the second adhesive region comprises a surface area less than a surface area of the first adhesive region.

9. The adhesive article of claim 1 wherein the second adhesive region comprises a surface area greater than or equal to about 22% of a surface area of the adhesive layer.

10

10. The adhesive article of claim 1 wherein the second adhesive region comprises a surface area that is more than about 22% of a surface area of the adhesive layer.

15

11. The adhesive article of claim 1 wherein the second adhesive region is selected from the group consisting of release liner material, repositionable pressure sensitive adhesive, polymeric film, paper, powder, scrims, nonwoven fabric, ink, and low adhesion backsize material.

20

12. The adhesive article of claim 1 comprising a two-sided adhesive tape article.

25

13. A mounting system for a substrate comprising:
a structure having a top portion and a bottom portion; and
an adhesive article adapted to attach the structure to the substrate, the adhesive article comprising an adhesive layer having a first adhesive region and a second adhesive region, the first adhesive region positioned to attach the top portion of the structure to the substrate and the second adhesive region positioned to attach a

bottom portion of the structure to the substrate, the second adhesive region comprising reduced adhesive properties.

5 14. The mounting system of claim 13 wherein the adhesive article comprises a stretch releasing adhesive tape.

 15. The mounting system of claim 13 wherein the adhesive layer is adapted to delaminate from the substrate by reverse peel.

10 16. The mounting system of claim 13 wherein the structure comprises a hook.

 17. An adhesive article adapted to attach structures to a substrate comprising an adhesive layer with a first adhesive region adapted to attach a top portion
15 of the structure to the substrate and a second adhesive region with reduced adhesive properties adapted to attach a bottom portion of the structure to the substrate, the adhesive layer being adapted to delaminate from the substrate by reverse peel.

 18. The adhesive article of claim 17 wherein the adhesive layer
20 comprises a plurality of adhesive regions.

 19. The adhesive article of claim 17 wherein the adhesive layer comprises a plurality of adhesive regions with progressively reduced adhesive
25 properties.

 20. The adhesive article of claim 17 wherein the adhesive layer comprises progressively reduced adhesive properties.

21. The adhesive article of claim 17 wherein the reduced adhesive properties comprise a reduction in a surface area in the second adhesive region relative to the first adhesive region.

5 22. The adhesive article of claim 17 wherein the second adhesive region comprises a surface area greater than or equal to about 22% of a surface area of the adhesive layer.

10 23. The adhesive article of claim 17 wherein the second adhesive region comprises a surface area that is more than about 22% of a surface area of the adhesive layer.

15 24. The adhesive article of claim 17 wherein the second adhesive region is selected from the group consisting of release liner material, repositionable pressure sensitive adhesive, polymeric film, paper, powder, scrims, nonwoven fabric, ink, and low adhesion backsize material.

20 25. The adhesive article of claim 1 comprising a two-sided adhesive tape article.

26. A method of attaching a structure to a substrate comprising the steps of:

25 preparing an adhesive article comprising an adhesive layer having a first adhesive region and a second adhesive region, the second adhesive region comprising reduced adhesive properties;

attaching the adhesive article to the structure so that the first adhesive region is adjacent to a top portion of the structure and the second adhesive region is adjacent to a bottom portion of the structure; and

engaging the first and second adhesive regions with the substrate.

27. The method of claim 26 wherein the adhesive article comprises a stretch releasing adhesive tape with a pull tab adjacent to the second adhesive region.

5 28. The method of claim 26 wherein the adhesive layer is adapted to delaminate from the substrate by reverse peel.

29. The method of claim 26 wherein removing the structure comprises the step of delaminating the adhesive article in a direction from the second
10 adhesive region toward the first adhesive region.

30. The method of claim 26 comprising preparing an adhesive article with a plurality of adhesive regions with progressively reduced adhesive properties on the adhesive layer.
15

31. The method of claim 30 wherein removing the structure from the substrate comprises the step of delaminating the adhesive article in a direction from the adhesive region with lowest adhesive properties toward the adhesive region with greatest adhesive properties.
20

32. The method of claim 26 comprising preparing an adhesive article where the second adhesive region comprises a surface area greater than or equal to about 22% of a surface area of the adhesive layer.

25 33. The method of claim 26 comprising preparing an adhesive article where the second adhesive region comprises a surface area that is more than about 22% of a surface area of the adhesive layer.

Abstract of the Disclosure

An adhesive article adapted to attach structures to a substrate and a method of using the same. The adhesive article has a failure mode that minimizes damage to the substrate surface. The adhesive article comprises an adhesive layer having a first adhesive region and a second adhesive region. The first adhesive region is adapted to attach a top portion of the structure to the substrate. The second adhesive region is adapted to attach a bottom portion of the structure to the substrate. The second adhesive region comprises reduced adhesive properties.

10

11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

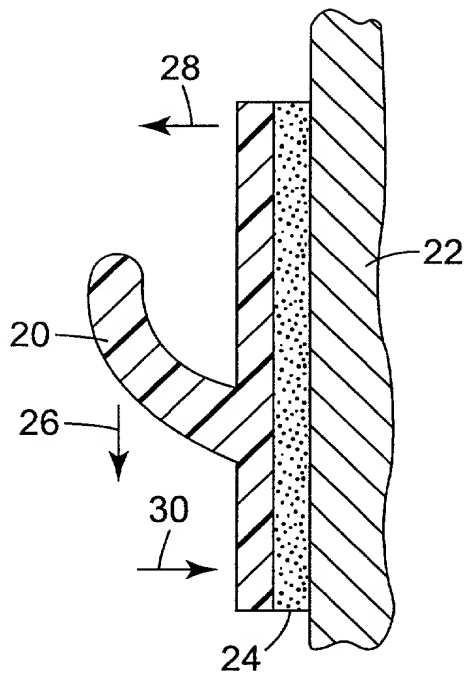


Fig. 1
PRIOR ART

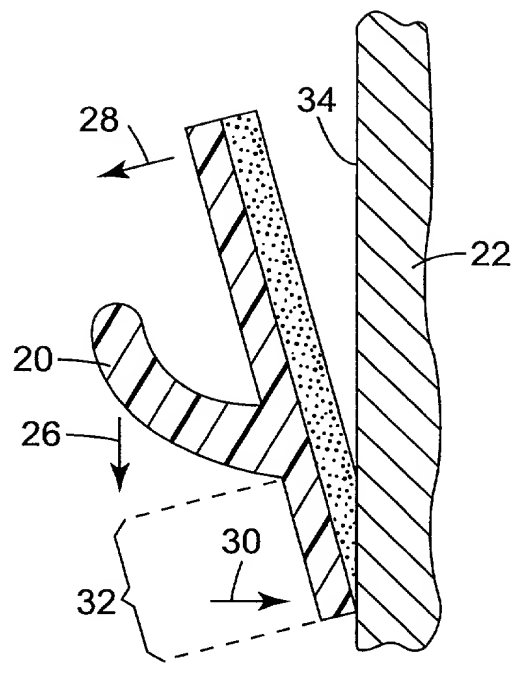


Fig. 2
PRIOR ART

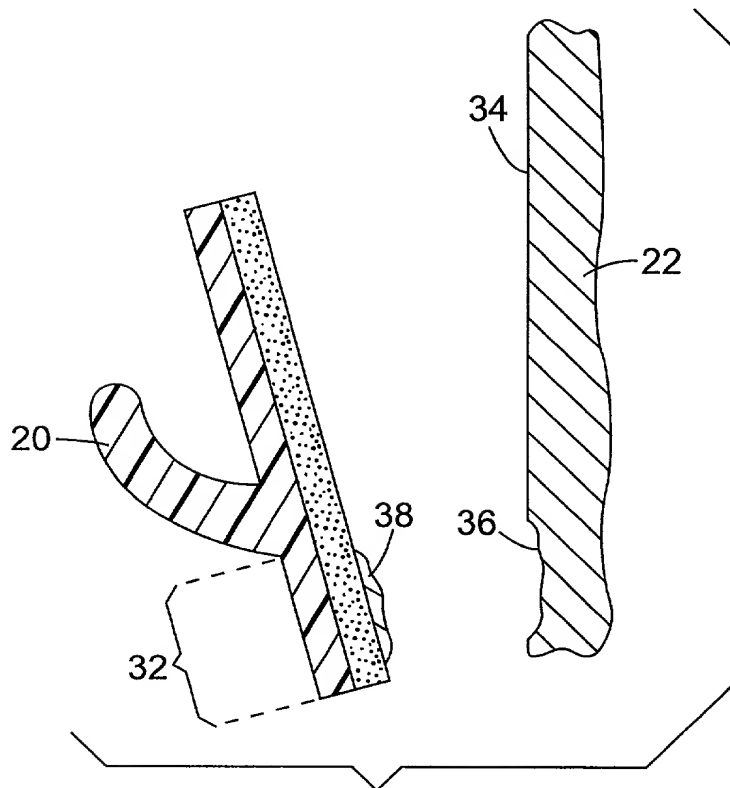


Fig. 3
PRIOR ART

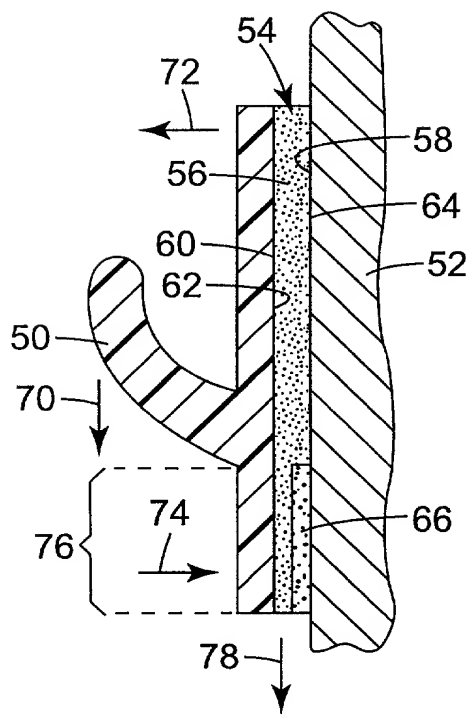


Fig. 4A

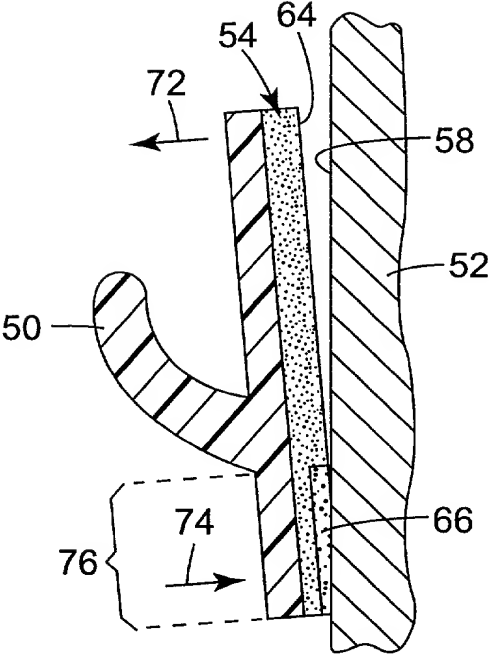


Fig. 4B

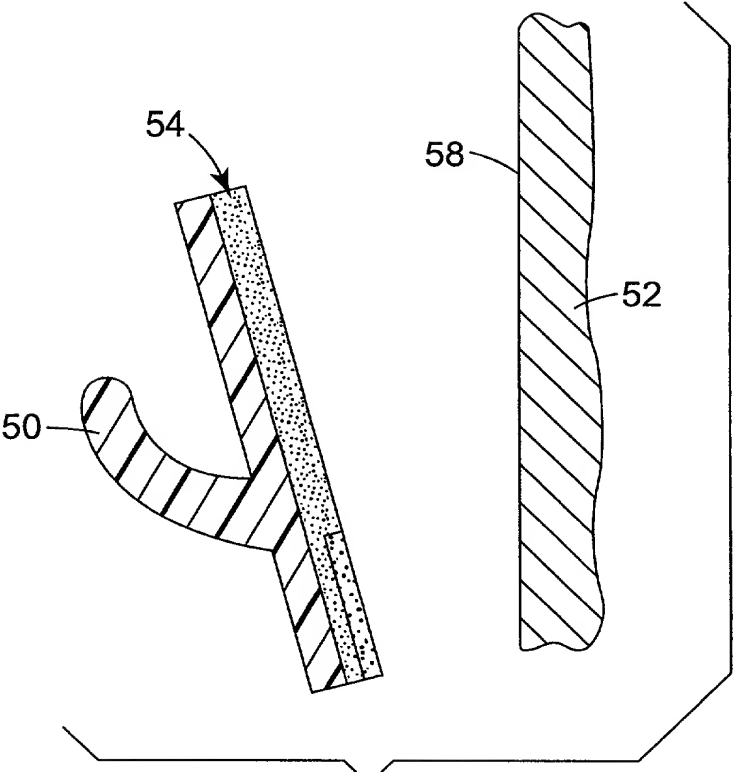


Fig. 4C

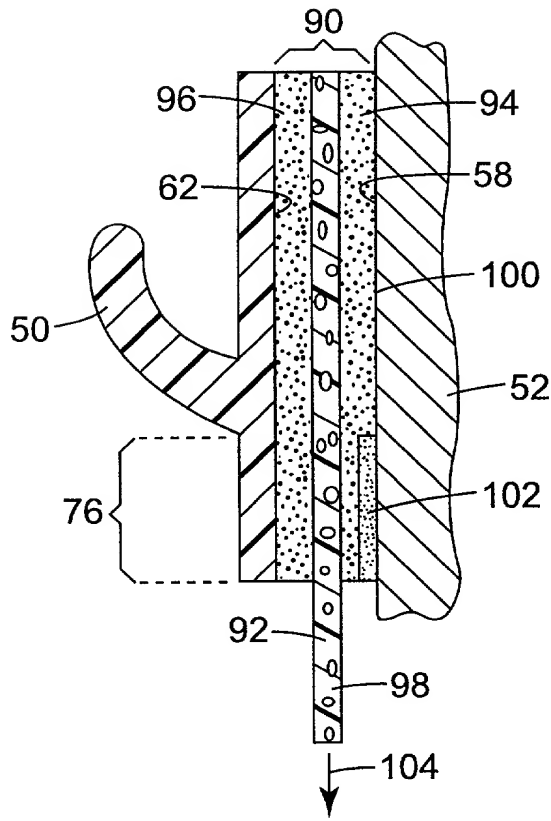


Fig. 5

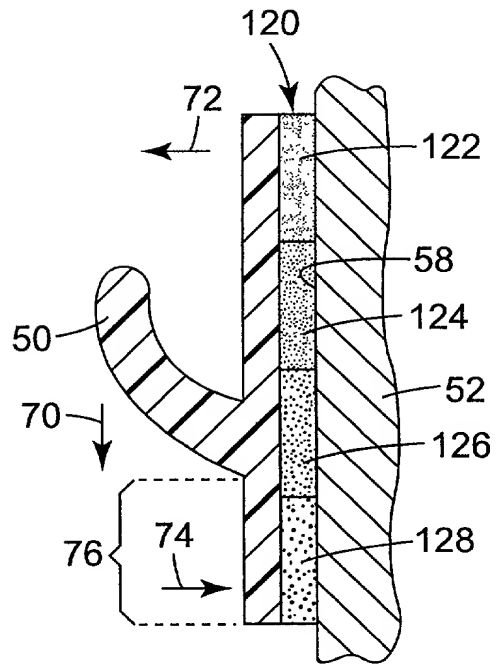


Fig. 6

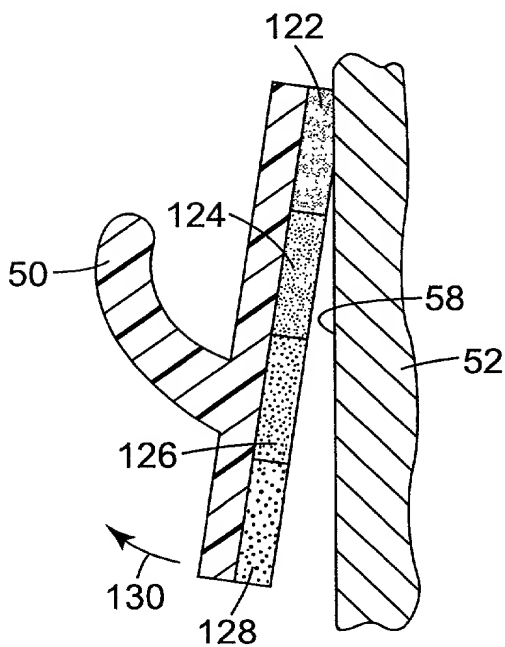


Fig. 7

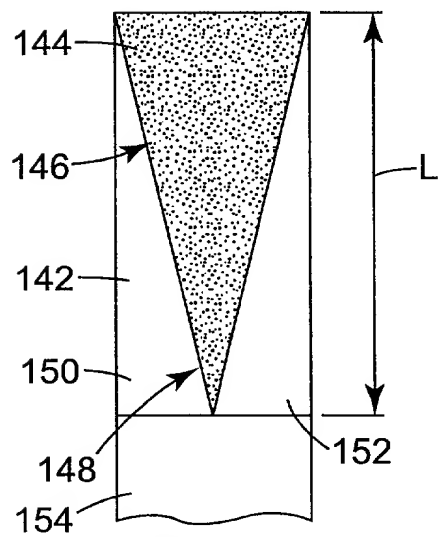


Fig. 8

DECLARATION, POWER OF ATTORNEY, AND PETITION

I, a below named inventor, depose and say that: (1) my residence, citizenship, and mailing address are indicated below; (2) I have reviewed and understand the contents of attached specification, including the claims, as amended by any amendment specifically referred to herein, (3) I believe that I am the original, first, and sole inventor or discoverer of the invention or discovery in

**ADHESIVE ARTICLE WITH PROGRESSIVE ADHESIVE PROPERTIES
AND METHOD OF USING SAME**

described and claimed therein and for which a patent is sought; and (4) I hereby acknowledge my duty to disclose to the Patent and Trademark Office all information known to me to be material to the patentability as defined in Title 37, Code of Federal Regulations, §1.56.*

I hereby appoint Gregory D. Allen (Reg. No. 35,048), Allen Ball (Reg. No. 42,286), Scott A. Bardell (Reg. No. 39,594), Carolyn A. Bates (Reg. No. 27,853), Stephen W. Bauer (Reg. No. 32,192), Dale A. Bjorkman (Reg. No. 33,084), Jennie G. Boeder (Reg. No. 28,952), William J. Bond (Reg. No. 32,400), Stephen W. Buckingham (Reg. No. 30,035), John A. Burtis (Reg. No. 39,924), Paul W. Busse (Reg. No. 32,403), Gerald F. Chernivec (Reg. No. 26,537), James D. Christoff (Reg. No. 31,492), Philip Y. Dahl (Reg. No. 36,115), Charles L. Dennis II (Reg. No. 30,555), Janice L. Dowdall (Reg. No. 31,201), Lisa M. Fagan (Reg. No. 40,601), Yen T. Florczak (Reg. No. 45,163), Darla P. Fonseca (Reg. No. 31,783), John A. Fortkort (Reg. No. 38,454), Melanie G. Gover (Reg. No. 41,793), Gary L. Griswold (Reg. No. 25,396), Doreen S. L. Gwin (Reg. No. 35,580), Michaele A. Hakamaki (Reg. No. 40,011), Karl G. Hanson (Reg. No. 32,900), Melissa M. Hayworth (Reg. No. P-45,774), Néstor F. Ho (Reg. No. 39,460), Rudolph P. Hofmann, Jr. (Reg. No. 38,187), Jeffrey J. Hohenshell (Reg. No. 34,109), Robert W. Hoke (Reg. No. 29,226), MarySusan Howard (Reg. No. 38,729), Stephen C. Jensen (Reg. No. 35,207), Robert H. Jordan (Reg. No. 31,973), Harold C. Knecht III (Reg. No. 35,576), Kent S. Kokko (Reg. No. 33,931), Charles D. Levine (Reg. No. 32,477), Douglas B. Little (Reg. No. 28,439), Eloise J. Maki (Reg. No. 33,418), Lisa M. McGeehan (Reg. No. 41,185), Matthew B. McNutt (Reg. No. 39,766), Michelle M. Michel (Reg. No. 33,968), William D. Miller (Reg. No. 37,988), Peter L. Olson (Reg. No. 35,308), Daniel R. Pastirik (Reg. No. 33,025), David B. Patchett (Reg. No. 39,326), Robert J. Pechman (Reg. No. 45,002), Carolyn V. Peters (Reg. No. 33,271), Scott R. Pribnow (Reg. No. 43,869), Ted K. Ringsred (Reg. No. 35,658), James A. Rogers (Reg. No. 37,228), Steven E. Skolnick (Reg. No. 33,789), Robert W. Sprague (Reg. No. 30,497), Brian E. Szymanski (Reg. No. 39,523), James J. Trussell (Reg. No. 37,251), and Lucy C. Weiss (Reg. No. 32,834), my attorneys and/or agents with full powers (including the powers of appointment, substitution, and revocation) to prosecute this application and any division, continuation, continuation-in-part, reexamination, or reissue thereof, and to transact all business in the Patent and Trademark Office connected therewith; the mailing address and the telephone number of the above-mentioned attorneys and/or agents are

Attention: David B. Patchett
Office of Intellectual Property Counsel
3M Innovative Properties Company
P.O. Box 33427
St. Paul, Minnesota 55133-3427
Telephone No. (651) 736-4713

The undersigned petitioner declares further that all statements made herein of his own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Wherefore, I pray for grant of Letters Patent for the invention or discovery described and claimed in the attached specification and I hereby subscribe my name to the foregoing specification and claims, declaration, power of attorney, and this petition, on the day set forth below.

 6/03/2000
Date

Michael D. Hamerski
Residence: Township of Baldwin, Wisconsin, U.S.A.
Citizenship: U.S.A.
Post Office: P.O. Box 33427
Address: St. Paul, Minnesota 55133-3427

*Title 37, Code of Federal Regulations, §1.56 is attached.

This form may be executed only when attached to the specification (including claims) as the last page thereof.

§1.56 Duty to disclose information material to patentability.

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
- (2) It refutes, or is inconsistent with, a position the applicant takes in:
 - (i) Opposing an argument of unpatentability relied on by the Office, or
 - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
- (2) Each attorney or agent who prepares or prosecutes the application; and
- (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.